

CLAIMS

I CLAIM AS MY INVENTION:

5 1. An insulating ceramic comprising a plurality of partially filled shapes disposed in a binding matrix.

 2. The insulating ceramic of claim 1 wherein the plurality of partially filled shapes comprises a dimensionally stabilized array of shapes.

10 3. The insulating ceramic of claim 1 wherein the plurality of partially filled shapes comprises shapes selected from the group consisting of oblate spheroid shapes, spheres, and shapes free of corners.

15 4. The insulating ceramic of claim 1 wherein each partially filled shape comprises an inner skeleton and an outer skin.

 5. The insulating ceramic of claim 4 wherein the outer skin of the shape ranges from about 0.1mm to about 5mm in thickness.

20 6. The insulating ceramic of claim 4 wherein the outer skin of the shape ranges from about 0.3mm to about 1.5mm in thickness.

 7. The insulating ceramic of claim 4 wherein the inner skeleton comprises a structure selected from the group consisting of a shaft, a cruciform and a jack-like structure.

25 8. The insulating ceramic of claim 4 wherein the inner skeleton comprises a foam material.

9. The insulating ceramic of claim 4 wherein the outer skin and inner skeleton comprise an alumina based material.

10. The insulating ceramic of claim 4 wherein the outer skin and inner
5 skeleton comprise an aluminosilicate material.

11. The insulating ceramic of claim 4 wherein the outer skin and inner skeleton comprise distinct materials.

10 12. The insulating ceramic of claim 4 wherein the inner skeleton comprises a silicon based material.

13. The insulating ceramic of claim 4 wherein the inner skeleton is stabilized at a higher temperature relative to the outer skin.
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14. The insulating ceramic of claim 4 wherein the inner skeleton comprises flyash.

15. The insulating ceramic of claim 4 wherein the outer skin comprises a
20 different material than the binding matrix.

16. The insulating ceramic of claim 4 wherein the outer skin of the plurality of partially filled shapes comprises the binding matrix.

25 17. The insulation ceramic of claim 4 wherein the outer skin comprises an encapsulation for the inner skeleton thereby providing environmental and/or chemical protection to the inner skeleton.

18. The insulating ceramic of claim 4 wherein inner skeleton fill material
30 volume is in the range from about 5% to about 40% of the volume defined by the outer skin.

18. The insulating ceramic of claim 18, wherein inner skeleton fill material volume is in the range from about 15% to about 20% of the volume defined by the outer skin.

5 20. An insulating ceramic comprising a close-packed array of partially filled spheroids, wherein any spheroid may be partially deformed to at least partially fill a void otherwise formed between adjacent spheroids.

10 21. The insulating ceramic of claim 20 wherein a total volume of voids filled by partially deformed spheroids comprises up to about 27% of the volume of the array.

15 22. The insulating ceramic of claim 4 wherein the plurality of partially filled shapes comprises a plurality of spheroids, and wherein the outer skin thickness is in the range from about 1% to about 30% of the sphere diameter.

23. The insulating ceramic of claim 22, wherein the outer skin thickness is in the range from about 5% to about 10% of the spheroid diameter.